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ABSTRACT

One of nine brief guides for special educators on using computer technology, this guide focuses on access including adaptations in input devices, output devices, and computer interfaces. Low technology devices include "no-technology" devices (usually modifications to existing devices), simple switches, and multiple switches. High technology input devices include advanced switches, video pointing devices, modified keyboards, alternative keyboards, voice recognition devices, and optical character readers. Among output devices are non-computer-dependent or computer-dependent devices (including print enlargers, braillers, and light/sound transmitters) and speech synthesizers. Interfaces used to connect various devices with the computer are briefly discussed. Listed are six readings, four low technology devices, four advanced switches, two video pointing devices, two modified keyboards, four alternative keyboards, two voice recognition devices, one optical character reader, five non-computer-dependent output devices, four computer-dependent output devices, four speech synthesizers, three computer interfaces, and a video. (DB)

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Center for Special Education Technology

Tech Use Guide

Using Computer Technology

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Computer Access

A high school student who is visually impaired has an assignment for his current events class: follow a recent major event and present available facts and analysis of the situation to the class. A major source of information for his classmates without visual impairments is the newspaper, but unless someone reads it to him, he cannot use that source. The radio is an available option but radio news coverage typically contains much less detail. However, with the available computer technologies, he can receive the newspaper on a computer disk and, using his personal computer equipped with synthesized speech, he can auditorily scan the newspaper, find the relevant articles, and have the computer read them to him. Using the same computer, he can begin to write his paper, print it out in braille so he can check it and change it if necessary, and then print it in standard text to hand in to his teacher.

The above scenario typifies the potential that new and emerging technology holds for individuals with disabilities. Its versatility, and the many applications that derive from that quality, are attracting attention from many who deal with disabilities. Computer access embodies the versatility of modern technology and its uses for persons with disabilities.

Access to computers may be achieved in a variety of ways and the same methods of access can be used with non-computer devices such as standard devices (such as battery operated toys) or specialty devices (which include environmental control units and communication aids). These access aids have been organized into three categories: 1) input (including low technology and high technology devices); 2) output; and 3) computer interfaces.

Low Technology Input Devices

Low technology input devices are readily available and can often be easily and inexpensively made. They range from no- technology devices to simple electrical switches.

No-Technology Devices. The no-technology devices are usually modifications to existing devices, either homemade or purchased. They provide better access or controlled access to another device. Examples include head pointers for accessing a communication board or a typewriter; elongated levers for on/off switches to allow gross motor control; and keyguards on typewriters or computers to inhibit unintentional key presses.

Simple Switches. These switches are capable of establishing two different electrical states — on or off. The electronics involved are quite basic and most people can easily learn to construct a simple switch. The external configuration of the switch can be built or purchased to meet the needs of the user. Some readily available types include pressure, contact, puff, light sensitive, and wobble switches.

Several videotapes and "how-to" books are available for those interested in constructing switches. These materials show how to make customized switches using readily available and inexpensive electronics.

Multiple Switches. In a multiple switch arrangement, two or more switches can be grouped to provide the user with multiple on/off options, each causing a different response.

High Technology Input Devices

Input devices that use more advanced technologies to meet the needs of individuals fall into this category. They range from devices that establish the same on/off state as the simple switches to devices that are different configurations of the standard computer keyboard with over 100 unique states.

Advanced Switches. High technology switches include those that can detect eye movements or noises and wireless devices that transmit signals to remote devices. For example, infra-red lights and ultrasonic soundwaves can allow the individual with disabilities to control devices, such as lamps, radios, TVs, and computers, when physically they cannot manipulate the on/off switches.

Video Pointing Devices. Two common video pointing devices are the joystick and mouse. These devices are used to "point" to places on the video screen. They have either a lever or a ball that can assume many positions. These devices measure the position of the lever or ball and tell a software program where the device is pointing. Each position can be considered a separate switch with a separate response.

Modified Keyboards. Modifications to standard keyboards can be hardware or software based. A common modification allows a sequence of keys to be pressed instead of concurrent presses. One handed or one finger typists cannot perform simultaneous key presses often

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required by computer software. A hardware modification may be constructed to add extra "fingers" to press several keys down at one time. A software modification might hold sequential key presses in memory for a short time and send all presses simultaneously to the program, letting it think that all were pressed at the same time. Other software modifications allow the user to define which key is what letter. This allows the most frequently used letters to be positioned where they can be more easily reached. Several do-it-yourself articles have been written on methods for modifying the keyboard inexpensively.

Alternative Keyboards. Alternative keyboards replace the standard keyboard, are generally more rugged, and have a variety of special features. They range from relatively inexpensive touch sensitive pads to precisely configured, molded keyboards with preset keys. Some are programmable so the user can decide which key will designate what on the keyboard and the size of the key can be changed to match the user's motor abilities. The features provided by the modified keyboards (e.g., removing the need for simultaneous key presses) usually come installed on alternative keyboards. Many of these keyboards are covered with a vinyl membrane which lends their use to young children and individuals with uncontrolled drooling. Some of the advanced keyboards allow the user to program levels of responses, that is, let each key return a variety of responses based on the level or mode the user has selected.

The last two groups of high technology input devices incorporate sophisticated technologies and are generally quite expensive. These technologies are commonly found in the community but usually in devices or machines that have a single purpose. As the technology becomes more developed they will become more flexible and will be more widely used as input devices for individuals with disabilities.

Voice recognition. Computers recognize the human voice by attempting to match the sound pattern of a word with its dictionary of sound patterns and their related meanings. For example, an individual with very limited motor control may use voice recognition to control a computer through spoken words or well differentiated sounds. The spoken word is recognized by the computer as if the word had been entered on the keyboard. To date, voice recognition systems are very limited in the number of words they can recognize and the tolerance for the variety of ways one word can be spoken, but improvements are being made all the time.

Optical character readers. Optical character readers are commonly used at the grocery store check-out stand. The black bars or UCP symbols on products are "read" by the machine. Each set of bars has a specific meaning. This same technology is being used for some augmentative communication boards for children who are nonverbal. Using a wand, the child passes over the bars, which have been matched with pictures or words, to produce preprogrammed words, phrases, or sentences with synthesized speech. Scanners can "read" written text. They are becoming popular in the work setting where a lot of text must be entered into a computer. Rather than type it, the text is scanned and it is automatically converted into the computer text. With a voice synthesizer attached, this technology can become a reading assistant for an individual with visual impairments.

Output Devices

Non-Computer-Dependent Devices. Output devices are either non-computer-dependent or computer-dependent devices. Non-computer-dependent devices include print enlargers, braillers, and light/sound transmitters. Some of these can be used with computer systems or have sister products designed for computer systems. Print enlargers range from simple magnifying glasses to sophisticated systems that allow the user to select the print size and scroll around a page, viewing the text on a high resolution monitor.

Braille is a system of printing in which a series of raised dots represent the letters of the alphabet. The reader feels the dots or letters to read the text. Braillers come in two basic forms: hard braille producers and soft braille producers. Hard braillers produce a paper copy of braille, permanently embossing dots on the paper, and function similar to a typewriter. The soft brailler vibrates pins in the braille configuration requiring the reader to feel the braille as it passes. There is no permanent record or paper copy of the braille transmitted.

Sound and light transmitters, in their non-computer-dependent form, come in several readily available devices for controlling electrical devices in the home. They may be used for controlling lights, radios, and other small appliances or included in security systems. Many of these devices do not require special adaptations for disabled individuals and can be purchased off- the-shelf.

Computer Dependent Devices. Many of the devices just described can also be used with a computer. The advantage to having a device which functions both ways is that access to information is not limited to just a printed source or just a computer source. Large print displays, braillers, and light/sound transmitters are all available in computer-dependent forms.

Speech Synthesizers. Although many non-computer devices incorporate speech synthesis (e.g., the Speak and Spell toy from Texas Instruments), the technology is microprocessor-based. There are two types of speech synthesizers available. The first type translates text into speech using the same set of rules all English speakers use. For example, a 'c' followed by an 'e' gets the soft 'c' sound like that of an 's'. All words are not translated correctly in this type of system because of the incredible number of exceptions to the rules in the English language. Additionally, text-to-speech synthesizers frequently sound very 'robotic.' The second type of synthesizer digitizes the human voice, records it, and plays it back on demand. This results in a human sounding voice, but the number of words or phrases available to the user are very limited

because this approach takes up a large amount of computer memory.

Computer Interfaces

Many of the devices described in this guide work independently of a computer system but can also be included in a system to add to the range of information and abilities the user with disabilities can access. In order to attach these devices to the computer, an interface — a device that will make the correct connection — is needed. Some devices use the standard interfaces provided on the computer. For example, joysticks and the mouse generally connect to a standard computer port which is either built in or readily available. Others require very special interface devices. Simple switches require a special switch interface that accepts the plug of the switch. Most switch producers also make a switch interface. Some interface devices are designed to accept more than one type of input device.

Computer access technology [illegible] many current advantages for individuals with disabilities and the promise of more to come as new hardware and software are developed and refined.

Readings

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Vanderheiden, G. Apple II repeat key modifications for headstick and one-finger typists. Unpublished manuscript, University of Wisconsin, Trace R&D Center, Madison, WI. Available from Trace R&D Center, University of Wisconsin-Madison, The Waisman Center, 1500 Highland Avenue, Madison, WI 53705, 608-262-6966.

Low Technology Devices

No Technology Devices, Simple Switches, Multiple Switches

AbleNet, AccessAbility, Inc., 1081 10th Avenue SE, Minneapolis, MN 55414, 612-379-0956.

Steven E. Kanor, Ph.D., Inc., 8 Main Street, Hastings-on-Hudson, NY 10706, 914-478-0960.

TASH, Inc., 70 Gibson Drive, Unit 12, Markham, ON Canada L3R 4C2, 416-475-2212.

Zygo Industries, Inc., P.O. Box 1008, Portland, OR 97207-1008, 503-684-6006.

High Technology Input Devices

Advanced Switches

Personics Corporation, 63 Great Road, Maynard, MA 01754, 508-897-1575.

Steven E. Kanor, Ph.D., Inc., 8 Main Street, Hastings-on-Hudson, NY 10706, 914-478-0960.

TASH, Inc., 70 Gibson Drive, Unit 12, Markham, ON Canada L3R 4C2, 416-475-2212.

Zygo Industries, Inc., P.O. Box 1008, Portland, OR 97207-1008, 503-684-6006.

Video Pointing Devices

Apple Computer, Inc., 20525 Mariana Avenue, Cupertino, CA 95014, 408-996-1010. Available from your local Apple dealer.

Microsoft Corporation, 16011 North East 36th Way, P.O. Box 97017, Redmond, WA 98073-9717, 800-426-9400. Available from your local computer dealer.

Modified Keyboards

Dvorak International, P.O. Box 128, Brandon, VT 05733, 802-773-3376.

Prentke Romich Company, 1022 Heyl Road, Wooster, OH 44691, 216-262-1984 or 800-642-8255.

Alternative Keyboards

J. Jordan Associates, 1127 Oxford Court, Neenah, WI 54956, 414-725-9046.

Sunburst Communications, 39 Washington Avenue, Pleasantville, NY 10570, 800-431-1934 (USA), 800-247-6756 (Canada), or 914-769- 5050 (call collect).

TASH, Inc., 70 Gibson Drive, Unit 12, Markham, ON Canada L3R 4C2, 416-475-2212.

Zygo Industries, Inc., P.O. Box 1008, Portland, OR 97207-1008, 503-684-6006.

Voice Recognition

Kurzweil Applied Intelligence, Inc., 411 Waverly Oaks Road, Waltham, MA 02154-8465, 617-893-5151.

Scott Instruments Corporation, 1111 Willow Springs Drive, Denton, TX 76205, 817-387-9514.

Optical Character Readers

Cauzin Systems, Inc., 835 South Main Street, Waterbury, CT 06706, 203-573-0150.

Output Devices

Non-Computer Dependent Devices

AbleNet, AccessAbility, Inc., 1081 10th Avenue SE, Minneapolis, MN 55414, 612-379-0956.

The Able Tech Connection, P.O. Box 2301, Kettering, OH 45429, 513-293-6803.

American Printing House for the Blind, P.O. Box 6085, Louisville, KY 40206-0085, 502-895-2405.

TASH, Inc., 70 Gibson Drive, Unit 12, Markham, ON Canada L3R 4C2, 416-475-2212.

Telesensory Systems, Inc., P.O. Box 7455, Mountain View, CA 94039-7455, 415-960-0920.

Computer Dependent Devices

Adaptive Communication System, Inc., Box 12440, Pittsburgh, PA 15231, 412-264-2288.

TASH, Inc., 70 Gibson Drive, Unit 12, Markham, ON Canada L3R 4C2, 416-475-2212.

Telesensory Systems, Inc., P.O. Box 7455, Mountain View, CA 94039-7455, 415-960-0920.

VTEK, Inc., 1625 Olympic Boulevard, Santa Monica, CA 90404, 800-345-2256, or 800-521-5605 (In California).

Speech Synthesizers

Digital Equipment Corporation, Educational Services, 146 Main Street, Maynard, MA 01754-2571, 508-663-4111 or 800-832-6277.

Educational Technology, P.O. Box 2377, Springfield, IL 62705, 800-323-7577.

Speech, Ltd., Management Efficiency Systems, 3790 El Camino Real, Suite 213, Palo Alto, CA 94306, 415-858-2207.

Street Electronics Corporation, 1140 Mark Avenue, Carpinteria, CA 93013, 805-684-4593.

Computer Interfaces

Don Johnston Developmental Equipment, Inc., P.O. Box 639, 1000 North Rand Boulevard, Building 115, Wauconda, IL 60084, 312- 526-2682.

Steven E. Kanor, Ph.D., Inc., 8 Main Street, Hastings-on-Hudson, NY 10706, 914-478-0960.

TASH, Inc., 70 Gibson Drive, Unit 12, Markham, ON Canada L3R 4C2, 416-475-2212.

Videos

Macomb Projects. (1988). Constructing a battery interrupter and a tread switch (Videotape). Macomb, IL: Author. Available from Macomb Projects, College of Education, 27 Horrabin Hall, Western Illinois University, Macomb, IL 61455, 309-298-1634.

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- Guide for Teachers
- Guide for Parents
- Guide for Disabled Adults
- Selecting Software
- Selecting Hardware
- Preschool Children
- Learning Disabilities
- Hearing Impairments
- Physical Disabilities
- Visual Impairments
- Telecommunication Networks
- Augmentation Communication

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